Handover Mechanisms in Next Generation Heterogeneous Wireless Networks

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged with the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

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ABSTRACT

New access technologies such as IEEE 802.11 Wireless LAN are emerging as a new means of public wireless access. Working on public unlicensed bands, they are capable of providing high speed data services, but small radio coverage. The third generation cellular networks such as Universal Mobile Telecommunications System (UMTS) provide wide radio coverage, but have limited data rates. An integration of these heterogeneous wireless networks is expected to be an effective means of providing high speed data access in wide radio coverage in the Next Generation (NG) wireless networks. When a mobile user moves across these networks, it has to perform handover to maintain its services. During a handover, it is pivotal to guarantee both service continuity and service quality, which ensure that handover can be made seamlessly. To provide ubiquitous services, an extensive collaboration between network operators is anticipated to be an economic solution. Providing seamless handover and ubiquitous services in heterogeneous wireless networks presents many new research challenges.

The objective of this thesis is to develop new handover management techniques for supporting seamless handover and facilitating ubiquitous services in heterogeneous wireless networks. More specifically, new techniques for dealing with the extensive collaboration of NG network operators, and new techniques that enable the interworking of heterogeneous wireless technologies.

Regarding the extensive collaboration of network operators, a neighbour network trust information retrieval scheme is proposed for global roaming. With this scheme, an access network can obtain network trust information of its nearby access networks without relying on direct links with them. The retrieved trust information can be provided to an attached mobile user later to assist it with global roaming. Next, a handover decision algorithm that uses network trust information is presented. The proposed algorithm guarantees much more reliable handover in a multiple-operator

environment. It is demonstrated how quality of service is maintained and overall network load is balanced using the proposed handover algorithm. The thesis moves further to a proxy based authentication localisation scheme that focuses on the handover across two networks without a trust relation. The proposed scheme provides a secure and effective method of localising authentication at a third-party entity during a handover. This avoids resorting to a mobile's home network for identity verification in a handover, and thus, greatly reduces handover latency.

In terms of the interworking of heterogeneous wireless technologies, the thesis presents a multi-interface mobile terminal model for media independent handover. The presented model addresses the challenge of working with heterogeneous wireless technologies from the perspective of a mobile terminal. Under the proposed multi-interface architecture, a mobile terminal can work with multiple network interfaces, and still uses common upper layer protocols such as Mobile IPv4. Being compatible with IEEE 802.21 framework, it uses a cross-layer design approach.